

Simulating effects of fire on gypsy moth caterpillars fed improved American chestnut

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Introduction

- American chestnut, *Castanea dentata*, was functionally eliminated from North American forests following introduction in 1904 of the exotic chestnut blight fungus, *Cryphonectria parasitica*
- Development of a blight resistant chestnut has been successful in recent decades
- Improved chestnuts are being field-tested throughout eastern forests. These trees have not been fully evaluated for
 - herbivore susceptibility
 - performance under silvicultural approaches such as prescribed fire
- Prescribed fire
 - is a common silvicultural prescription used to facilitate regeneration and manipulate stand composition
 - provides an influx of nutrients and alters light penetration, likely affecting seedling performance
 - may alter production of defensive compounds and foliar nutrients, with repercussions for insect herbivores

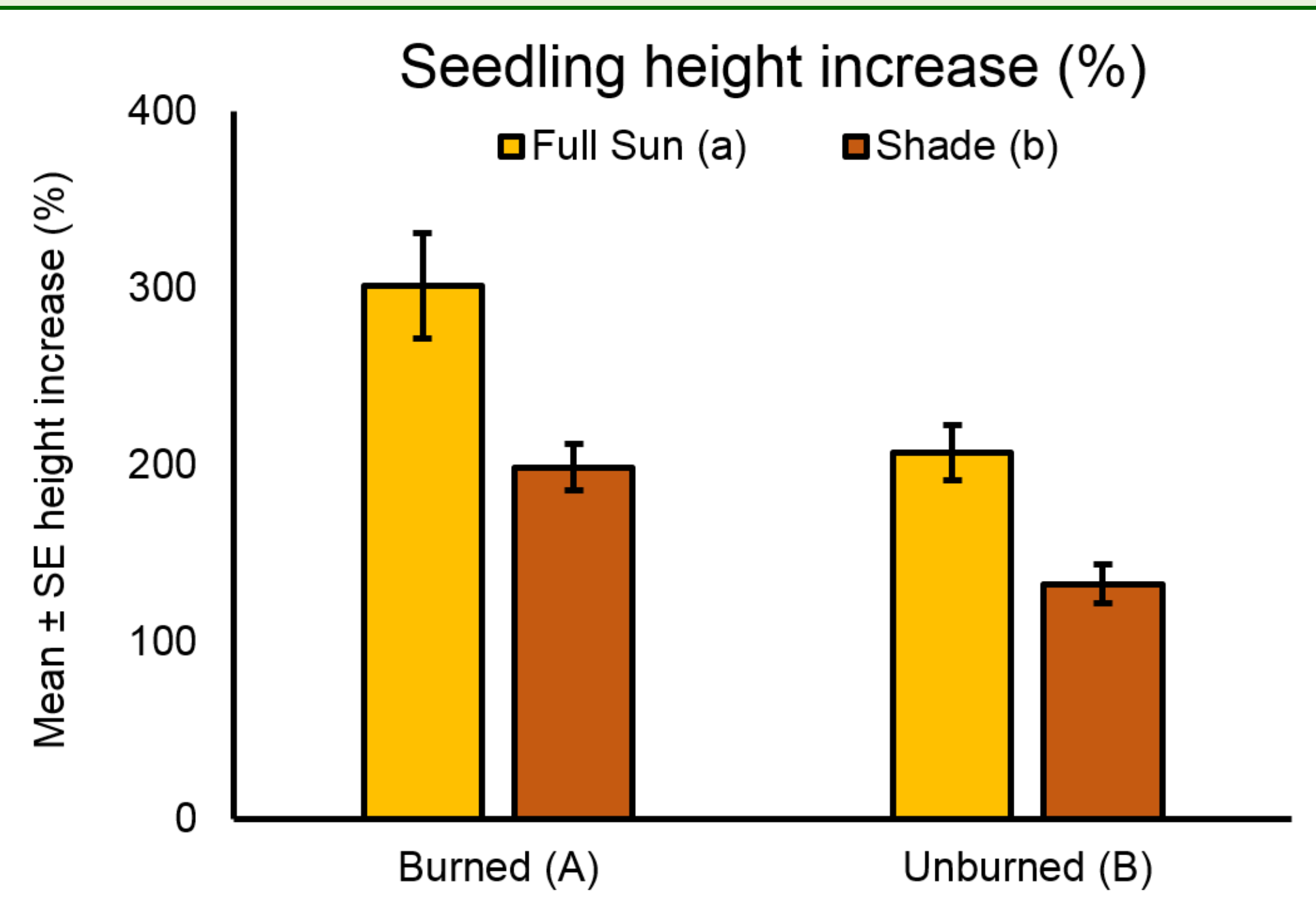
Objectives

We simulated the effects of prescribed fire on chestnut seedlings in a green house, and evaluated seedling suitability to larvae of the gypsy moth, *Lymantria dispar dispar*, a generalist herbivore. We manipulated soils and light availability to tease apart the effects of nutrient and light availability on seedling growth and herbivore suitability.



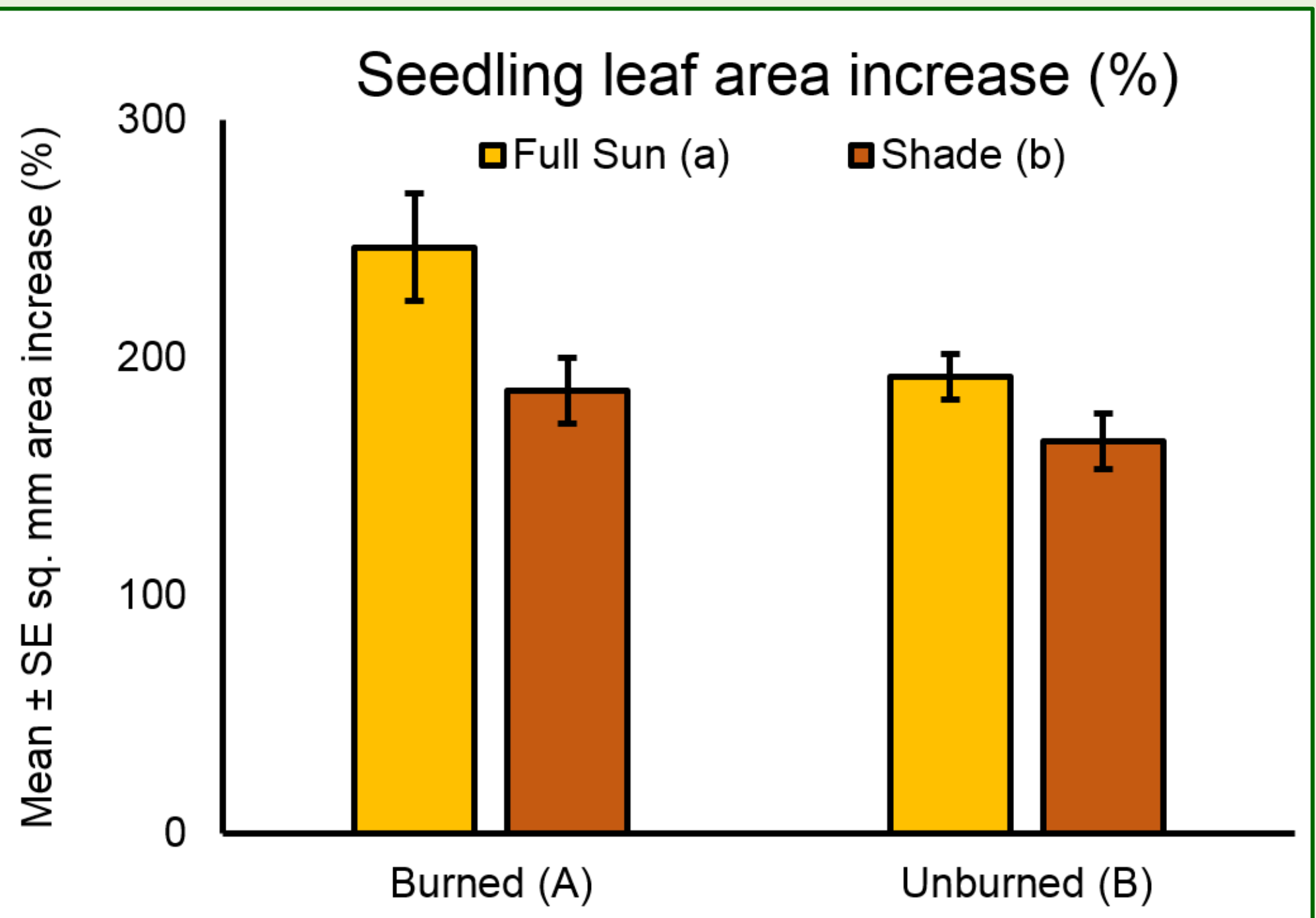
Methods – Chestnut Seedlings

Forest soils were collected from a newly burned and adjacent unburned site on the Daniel Boone National Forest (April 2015) and used in pots to grow improved chestnuts from seed under full sun (no shade cloth) and shade (70% shade cloth) in a 2 × 2 greenhouse experiment



$F_{3,18} = 12.0, P < 0.001$; 2×2 ANOVA, main effects significant, no interaction

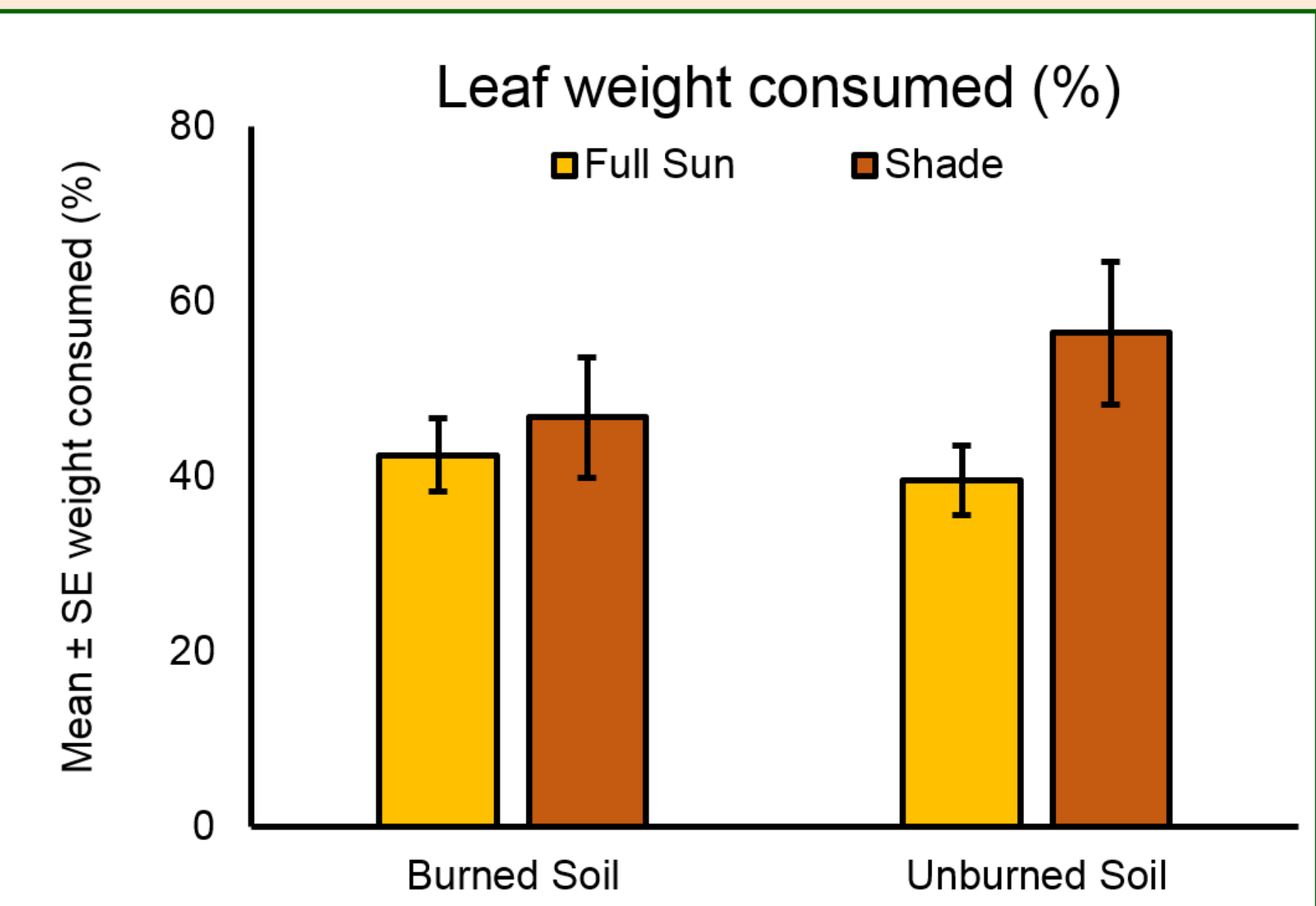
Results – Chestnut seedlings grown in burned soil and full sun had greater height growth (left) and leaf availability (right) than those grown in unburned soil and shade.



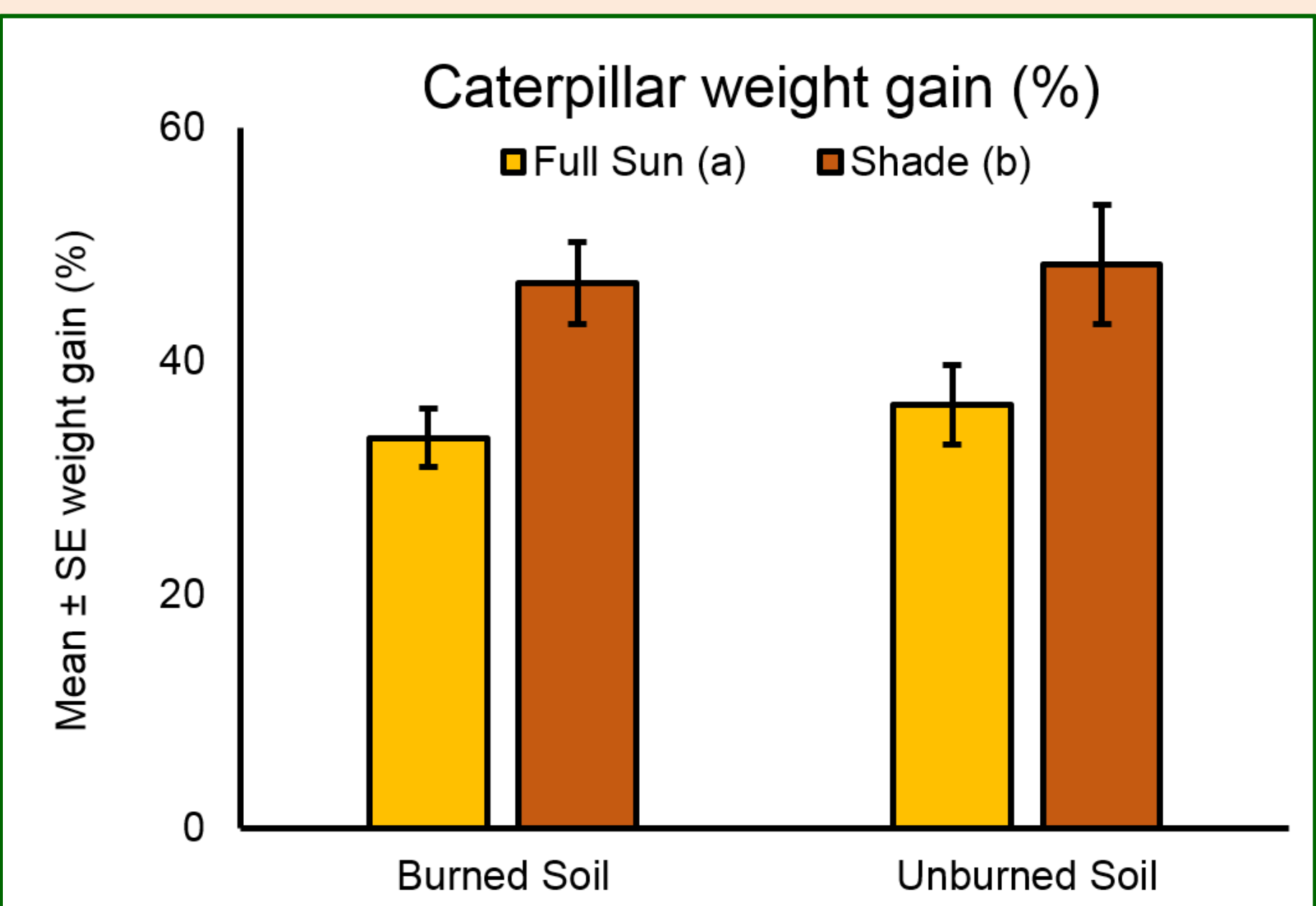
$F_{3,18} = 4.81, P = 0.02$; 2×2 ANOVA, main effects significant, no interaction

Methods – Herbivore Feeding Trial

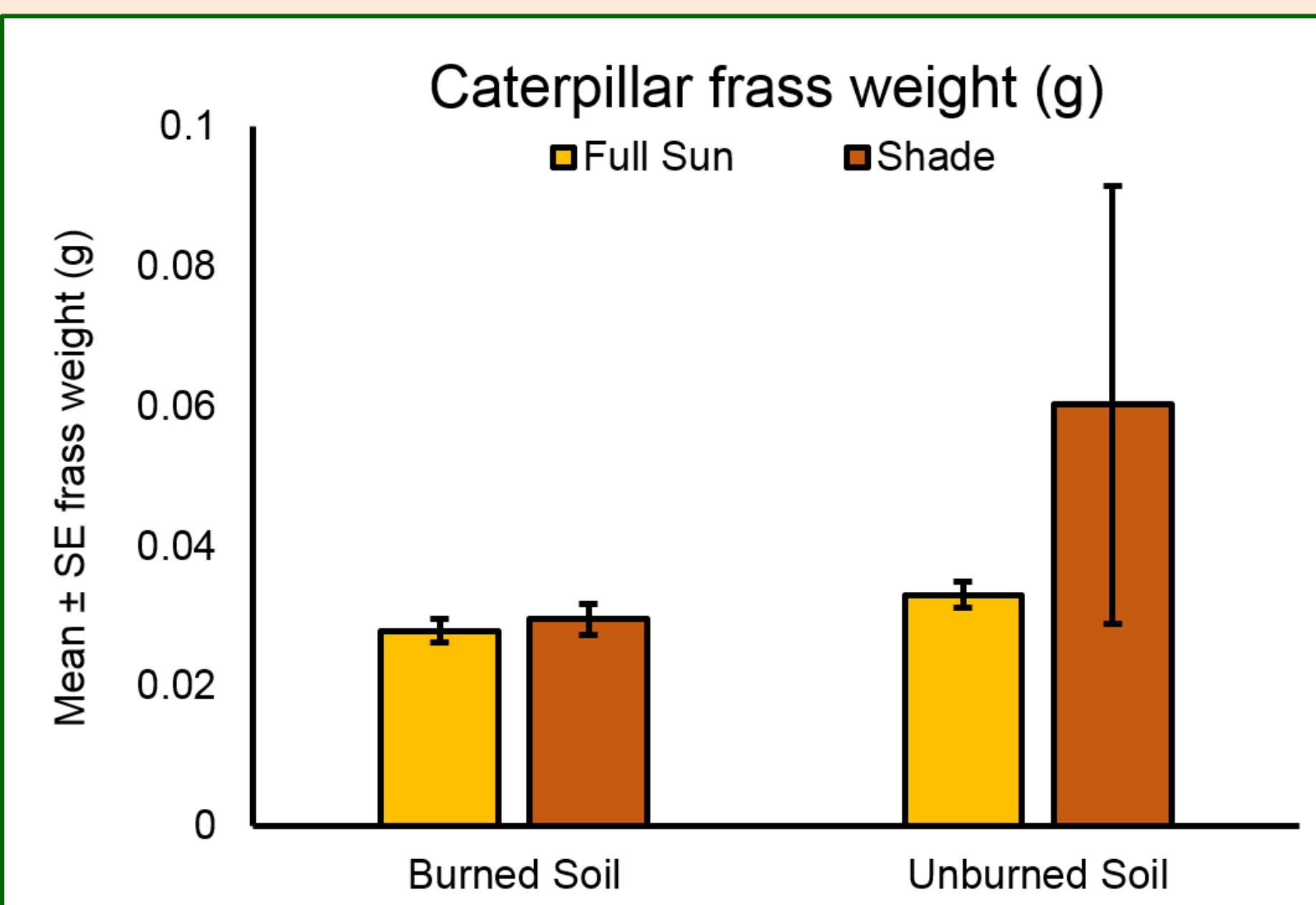
Feeding assays were conducted after 30 d. Newly molted 4th instar gypsy moth larvae were starved for 48 h before being placed on newly excised chestnut leaves in assay chambers (N = 10 caterpillars per seedling treatment) and allowed to feed for 24 h. Caterpillars, frass, and leaf material were weighed before and after the assay.



$F_{3,38} = 1.5, P = 0.2$; 2×2 ANOVA, data arcsine sqrt transformed



$F_{3,38} = 4.9, P = 0.01$; 2×2 ANOVA, data arcsine sqrt transformed



$F_{3,38} = 0.8, P = 0.5$; 2×2 ANOVA, data log transformed



Results – Gypsy moth did not alter consumption due to the effect of soil burned by fire, but these caterpillars did not grow as large under the increased light typical of burned forests (above center).



Implications

- Prescribed fire affects chestnut seedling performance and herbivory by a generalist
- A more complete understanding of how these improved chestnuts will interact with biotic and abiotic forces should be obtained prior to full scale deployment

Acknowledgements

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